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09/628,116	07/28/2000	Roman Sobolewski	M-8821 US	2593

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EXAMINER
MORAN, TIMOTHY J

ART UNIT	PAPER NUMBER
2878	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/628,116	Applicant(s) SOBOLEWSKI ET AL.	
	Examiner Timothy J. Moran	Art Unit 2878	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 September 2002*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-19* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-19* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
4) ☐ Interview Summary (PTO-413) Paper No(s). _____
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-13 and 16-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hoyle, U. S. Patent No. 4,037,102 in view of Il'in, "Ultimate quantum efficiency of a superconducting hot-electron photodetector." Regarding claim 1, Hoyle teaches a method of detecting photons (col. 9, lines 32-34), comprising the acts of providing a superconductor strip (fig. 8, element 98, col. 8, lines 50-52) maintained below its critical temperature (col. 6, lines 12-18 teaches that the strip is in the superconducting state), electrically biasing said superconductor strip (col. 10, lines 12-24), directing light onto said biased superconductor strip (col. 9, lines 32-34), wherein

said biasing is at a level near said superconductor strip's critical current (col. 6, lines 8-19) to enable detection of very small energy amounts. Hoyle does not explicitly teach the use of this method for the detection of single photons, but one skilled in the art of light detectors would recognize the advantage of a detector with a sensitivity high enough to detect single photons. Hoyle does teach that strips with small widths are sensitive to lower energy impacts (col. 6, lines 19-37 and lines 42-46, and col. 9, lines 12-34, fig. 10). In addition, Il'in teaches that the detection of single photons by superconducting strip detectors has a reasonable chance of success. Thus, one skilled in the art would therefore understand that by properly decreasing the width of the channel (or strip), the detection of single photons has a reasonable chance of success. Therefore it would have been obvious to one of ordinary skill in the art to provide for the detection of a single photon in the method of Hoyle.

Regarding claim 2, Hoyle discusses the output pulse from the superconductor strip (col. 6, lines 33-42).

Regarding claim 3, niobium nitride is well known in the art as a superconductor material useful in detectors. Therefore, absent a showing of criticality, it would have been obvious to one of ordinary skill in the art to provide for a superconductor strip of niobium nitride in the modified method of Hoyle.

Regarding claim 4, Hoyle teaches the use of lasers and equivalent sources of energy may be used with the detector method. The use of superconductor materials to detect infrared radiation is well known in the art. Therefore it would have been obvious

to one of ordinary skill in the art to provide a single photon with a wavelength between the visible and the far infrared spectral regions in the modified method of Hoyle.

Regarding claim 5, Hoyle (fig. 9) teaches the use of a superconductor strip which defines a meander.

Regarding claim 6, Hoyle teaches the use of a strip with a width generally greater than or equal to 1 micron (col. 5, lines 35-41). However, Hoyle also teaches the advantage of using smaller widths with the advantage of the ability to detect smaller amounts of radiation (col. 9, lines 12-34, fig. 10). Therefore, it would have been obvious to one of ordinary skill in the art to provide for a superconductor strip with a width equal to or less than about 200 nm in the modified method of Hoyle.

Regarding claim 7, as described above, Hoyle describes a photon detector comprising a superconductor film coupled to a bias source, where said superconductor film is in the superconducting state and biased near its critical current. Hoyle also teaches the advantage of using strips with small widths, which would indicate to one of ordinary skill in the art the likelihood of success of this method for the purpose of detecting single photons. Therefore it would have been obvious to one of ordinary skill in the art to provide for a superconducting film dimension which allows detection of a single incident photon in the device of Hoyle.

Regarding claim 8, niobium nitride is well known in the art as a superconductor material useful in detectors. Therefore, absent a showing of criticality, it would have been obvious to one of ordinary skill in the art to provide for a superconductor strip of niobium nitride in the modified device of Hoyle.

Regarding claim 9, Hoyle teaches the use of a strip with a width generally greater than or equal to 1 micron (col. 5, lines 35-41). However, Hoyle also teaches the advantage of using smaller widths (col. 9, lines 12-34, fig. 10). Therefore, it would have been obvious to one of ordinary skill in the art to provide for a superconductor strip with a width equal to or less than about 200 nm in the modified device of Hoyle.

Regarding claim 10, Hoyle teaches the formation of a detectable resistive region upon absorption of an incident photon onto the superconducting film (col. 6, lines 8-37).

Regarding claim 11, Hoyle teaches (fig. 3, element 50 and neighboring film portions, col. 4, lines 18-35) the use of wires coupled to pads at the ends of the superconducting film (64), and the use of such wires (50) to connect to the biasing source (col. 4, lines 13-17).

Regarding claim 12, Hoyle (fig. 9) teaches the use of a superconductor strip which defines a meander.

Regarding claim 13, Hoyle does not teach the use of gold in the contact pads, but does teach the use of "other conventional methods of securing leads at superconductive temperatures" (col. 4, lines 31-35). Gold is well known in the art as a useful material for achieving electrical contact to thin films. Therefore it would have been obvious to one of ordinary skill in the art to provide contact pads which include gold in the modified device of Hoyle to achieve good electrical contact.

Regarding claims 16 and 18, Hoyle does not explicitly teach the method of producing an output pulse which has a voltage greater than 1 mV. However, Hoyle does teach the production of output pulses with voltage of approximately 0.1 mV, and gives

guidance on methods of increasing the sensitivity of the method (col. 8, lines 28-30 and col. 9, lines 12-34). The increase of output signal from 0.1 mV to 1 mV is considered to be within the ability of one of ordinary skill in the art. Therefore it would have been obvious to one of ordinary skill in the art to provide for an output pulse having a voltage greater than 1 mV in the modified device of Hoyle for the advantage of a larger signal.

Regarding claims 17 and 19, Hoyle teaches (col. 6, lines 21-37) that the radiation creates a resistive region extending across the width of said superconductor strip.

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hoyle and Il'in as applied to claim 7 above, and further in view of Bornstein, U. S. Patent 4,987,305. Hoyle does not teach the coupling of light to the superconducting film using an optical fiber. However, Bornstein (fig. 3, abstract and col. 5, lines 44-55) teaches the coupling of light to an infrared detector (15) using an optical fiber (17) with the advantage of greater freedom in placement of detectors relative to light sources (col. 4, lines 3-10). Therefore it would have been obvious to one of ordinary skill in the art to provide for the coupling of light to the superconducting film using an optical fiber in the modified device of Hoyle for the advantage of greater freedom of structural design.

Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hoyle and Il'in as applied to claim 7 above, and further in view of Weirauch, U. S. Patent No. 5,828,068. Hoyle does not teach the coupling of light to the superconducting film through a hemispherical lens. However, Weirauch (fig. 3) teaches the coupling of light to an infrared detector (10) through a hemispherical lens (18) for the advantage of collecting light from a large range of angles (col. 4, lines 27-30). Therefore it would have

been obvious to one of ordinary skill in the art to provide for the coupling of light to the superconducting film through a hemispherical lens in the modified device of Hoyle for the advantage of collecting infrared light from a wide range of angles.

Response to Arguments

Applicant's arguments filed September 13, 2002 have been fully considered but they are not persuasive.

In response to applicant's argument (pages 2-4) that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, Hoyle is the primary reference, while Il'in is used mainly to provide guidance on the probability of success of single photon detection.

In response to applicant's argument (page 2, sentence starting with "However, this is in the context..." and elsewhere) that Hoyle does not teach the detection of photons, the applicant is directed to Hoyle, col. 9, lines 32-34, which teaches the use of the device of Hoyle for detection of photons. The rejections made in the office action mailed May 15, 2002, are based on this teaching of the Hoyle patent.

In response to applicant's argument (page 3, second paragraph) that there is no suggestion to combine the references since the Il'in reference teaches operation above

the critical temperature while Hoyle teaches operation below the critical temperature, applicant is directed to Hoyle (col. 5, lines 3-6 and col. 6, lines 12-18). Hoyle teaches that the detecting element is to be maintained near, and below, its critical temperature in order to be effective for detecting photons. Applicant is also directed to Il'in (page 3939, col. 1, last paragraph, sentence starting with "Thus, our studied..." and page 3940, col. 2, sentence starting with "The above..."), which teaches that superconducting thin film radiation detectors operating in the superconducting transition temperature region are likely to be effective in detecting single photons. The temperature ranges taught by the Hoyle and Il'in references are considered to be very similar, and possibly even overlapping considering the uncertainty in the width of a "superconducting transition region." Therefore, one skilled in the art and in possession of an understanding of the Hoyle reference would be led by the Il'in reference to conclude that a detector according to Hoyle would have a reasonable chance of success at detecting individual photons.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Irwin, U. S. Patent No. 5,880,468 describes a single photon detector (X-ray calorimeter) comprising a superconducting thin film (col. 1, line 41-col. 2, line 1 and references described therein).

All claims are drawn to the same invention claimed in the application prior to the entry of the submission under 37 CFR 1.114 and could have been finally rejected on the grounds and art of record in the next Office action if they had been entered in the application prior to entry under 37 CFR 1.114. Accordingly, **THIS ACTION IS MADE**

FINAL even though it is a first action after the filing of a request for continued examination and the submission under 37 CFR 1.114. See MPEP § 706.07(b). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Timothy J. Moran whose telephone number is 703-305-0849. The examiner can normally be reached on M-F 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Porta can be reached on 703-308-4852. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7724 for regular communications and 703-308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

T. M.

TM
October 28, 2002

DAVID PORTA
SUPERVISORY PATENT EXAMINER
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